FARADAY

B

XX
IV

THE STORY OF AN ERRAND-BOY WHO CHANGED THE WORLD

B. xxiv. 1av

6459

1831—1931

The FARADAY CENTENARY

An Errand-boy who changed the World

THE Faraday Centenary of 1931 commemorates the fact that one hundred years ago Michael Faraday, the son of a Yorkshire blacksmith, made a discovery—not by chance, but by logical reasoning and sheer perseverance—which has done more than any other to change the face of the world.

It has been said—the statement has even appeared in print—that Faraday "discovered electricity." This is not the right way to express the significance of his work. Faraday's claim to honour is that he showed us how to produce electricity in a more effective way and on a much larger scale than was possible before, as we shall see. But first let us learn a little about him.

Michael Faraday was born on September 22, 1791, at Newington, Surrey, then a village surrounded by country lanes and fields, but now lost, except for its name, in the maze of South London. His father came southward from Yorkshire two or three years before Michael was born.

The family moved from Newington to a mews in Charles Street, Manchester Square, Bayswater, in 1796—a poor stage-setting, it might appear, for the opening scenes of a great scientist's life; and it remained unchanged for some years, for at the age of ten Michael became errand-boy at the shop of a stationer and bookbinder in Blandford Street, close to his home. "Lending out" the daily papers for a small charge was then a common practice, and he used to take the newspapers round to his master's customers every morning, very early, calling for them later. After twelve months of running errands he was apprenticed at the same shop, and began to learn bookbinding; to this may be attributed the first inspirations that led to his wonderful career—for many volumes on scientific themes passed through his hands, and the boy read them eagerly, making copious notes on anything that specially appealed to him. To the mysterious subject of electricity he was strongly drawn, and in 1812 he began experimenting on his own account, making a small battery of the

". . . be used to take newspapers round . . ."

type known at that period as the "Voltaic pile," which "worked," much to his delight.

Within him lay hidden the desire to increase his knowledge, to seek a wider field; the longing, not for fame but for a fuller and more interesting life; and this moved him to action when the opportunity arrived. Eight years passed, during which he must have read hundreds of books; we know that in this interval he studied chemistry, carried out many experiments, and constructed models—his original "electrical machine" is still treasured at the Royal Institution. Gradually, unknowingly, he was preparing himself for his future life-work, and though he had his trade, it did not satisfy him. He wrote to Sir Joseph Banks, President of the Royal Society, asking to be given some employment, however humble, which might bring him into closer touch with scientific matter; but no answer came. A customer of his master, however, took him to hear a course of lectures on chemistry by Sir Humphry Davy at the Royal Institution—a memorable event

". . he must have read hundreds of books . . ."

for the eager youth of twenty-one; and this proved to be the critical point. He made full notes, copied them out with extreme care in his beautiful, decorative handwriting, bound them, and sent them to Sir Humphry in December 1812, with a letter expressing his distaste for a business life and asking the great man's help in obtaining some more congenial work. The appeal impressed Sir Humphry and he replied kindly; but in an interview he suggested that the young man would do better to stick to his trade, promising him the book-binding of the Institution. Soon afterwards, however, the opportunity came. The assistant in the laboratory of the Institution had proved unsatisfactory; had been, in fact, "ejected" for unruly conduct and general inefficiency. Davy remembered the young applicant, sent for him, and at this second conversation asked him if he still wished to change his occupation. There could be no doubt of the reply, and as a result Faraday was formally engaged as laboratory assistant on March 1, 1813, his salary being 25s. a week. Thus, through his

"... *be carried out many experiments* ..."

own efforts, began an association with the celebrated building in Albemarle Street, Piccadilly, which was to continue unbroken for his whole life.

The details of that long life we must leave to the biographies; the discoveries, however, which made the name of Faraday immortal, and which lead us to regard him as "the father of electrical science," must be briefly described.

It was known that a current of electricity could cause a piece of soft iron to become a magnet; Faraday, arguing as it were, backwards, believed that somehow a magnet ought to be able to generate electricity, or in some way, to affect an existing current. Many times he tried to produce this phenomenon, but the logical event refused to happen.

In 1831 he succeeded, and discovered the fundamental principles of electro-magnetic induction. His first step towards success was made on August 29, when he wound two coils of wire on the opposite sides of an iron ring, connected one coil to a battery and the other to a wire passing over a

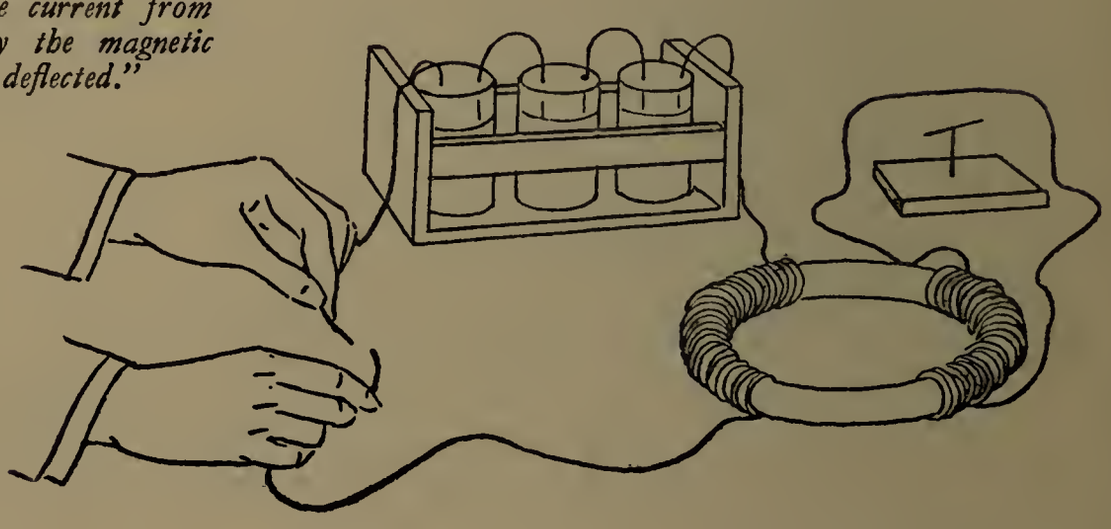
The Royal Institution.

magnetic needle. He found that whenever he started or stopped the current from the battery the magnetic needle was deflected, showing that the magnetism produced by the first coil induced a momentary current in the second coil.

By patient and determined investigation during the next few weeks he discovered that when he moved a magnet close to a coil of wire, he again produced momentary currents in the coil. By rotating a disc or coil between the poles of a magnet, Faraday obtained a steady current of electricity, and so made the first dynamo.

These experiments, simple though they seem to us, may be regarded as the foundation of all our modern electrical progress. Many clever engineers have developed Faraday's work; but the fact remains that the immense electrical generating sets of our power stations to-day are but elaborations of his discovery that by rotating coils of wire in a magnetic field electricity is generated. We are able to collect these momentary currents, to multiply them enormously, to raise them to high pressures, to control them, to convert them into a steady flow, to make them do the work of the world; yet the principle remains unaltered.

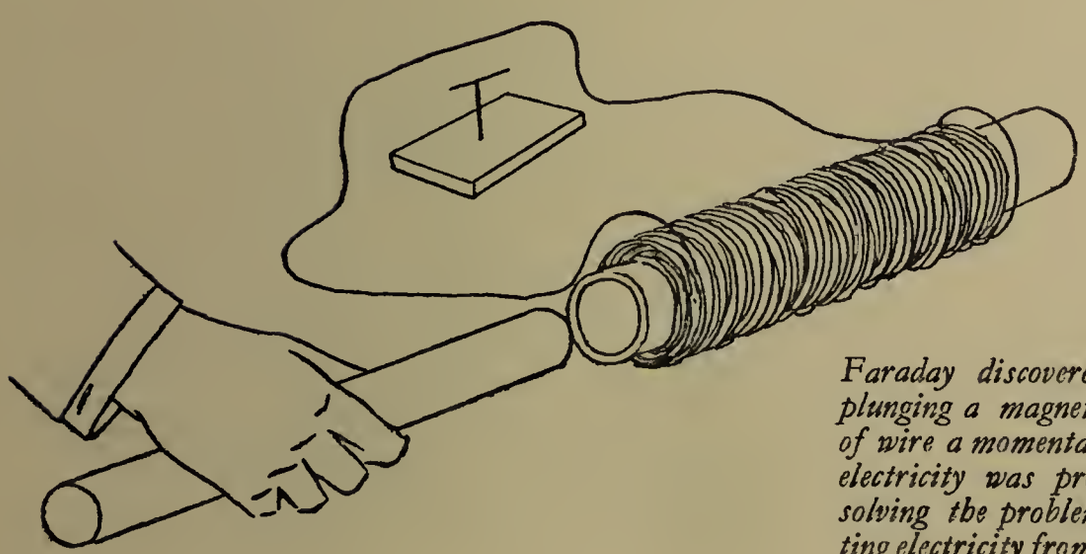
Faraday's ring experiment.
"... whenever he started or stopped the current from the battery the magnetic needle was deflected."



This is the finest and most famous contribution which our great philosopher made to science, for which his name appears in every electrical textbook, and which is commemorated this year, exactly a century after.

It is not his only title to fame; in chemistry he was almost as eminent; but it is what we are chiefly concerned with in the present centenary.

Faraday possessed an extraordinarily enquiring mind, an apparently unlimited power for steady work, and many of the conclusions at which he arrived were proved to be correct years afterwards. A prediction which he made with regard to the behaviour of an electric current under certain conditions was confirmed sixteen years later—a brilliant instance of his intuition. He carried on a great deal of pioneer research upon what happens when electricity is passed through liquids, and thus laid the foundations of the electro-deposition of metals—known commonly as electro-plating. It is pleasant to remember that he began the Christmas lectures to



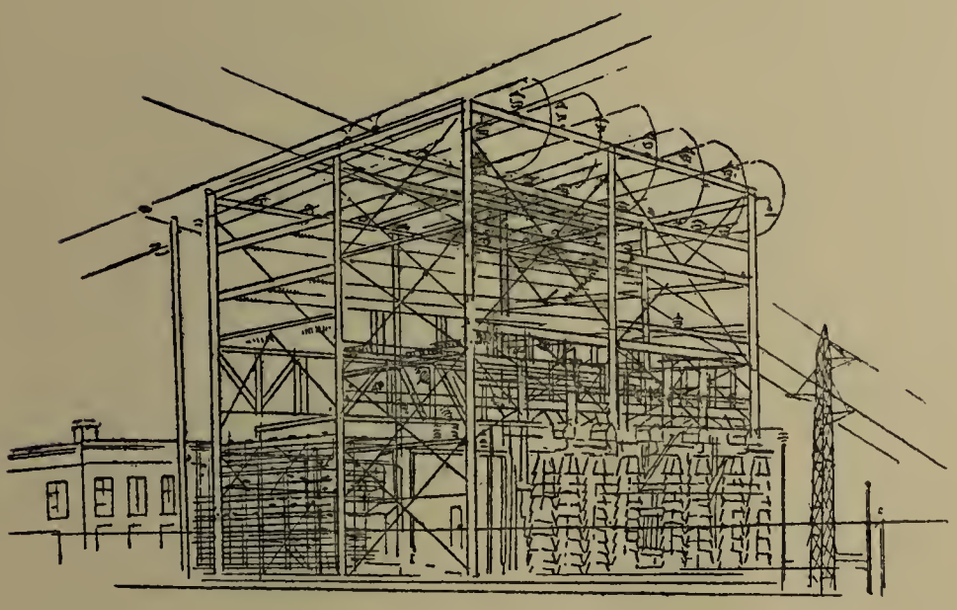
Faraday discovered that by plunging a magnet into a coil of wire a momentary current of electricity was produced, thus solving the problem of generating electricity from magnetism.

boys and girls which are now an annual event at the Royal Institution; and though childless he was extremely fond of children and was never happier than when playing games or giving a party in his rooms at the Institution. If he had no particular hobby or recreation, he joined in any fun that was going on, and all who knew him mention the brightness and vivacity of his manner, his frankness, his vividness of expression. Money made no appeal to him, except as a means to live in moderate comfort, and he was generous to all—his gifts to the poor and the sick amounted to several hundred pounds a year. In fact our professor was as good as he was great, and as one of his intimate friends said, "a boy at heart."

Faraday died in 1867, in the house at Hampton Court provided for him by the thoughtfulness of Prince Albert and the Queen; his life a fragrant memory, uneventful except in science and the adventures of the mind, happy, honoured, calm, and full of faith.

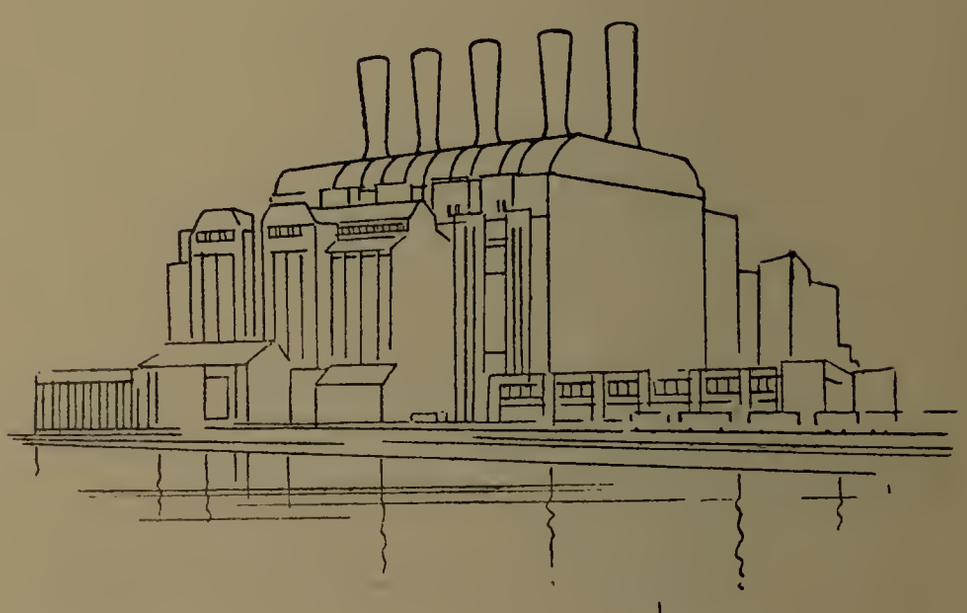
Faraday believed in demonstrating a fact visually in order "to allow the brain to grasp it more easily."

His work remains, his influence continues, often unsuspected by those who owe most to it. For it pervades the entire fabric of our civilisation. The smoothly running electric train, the magneto of the car and aeroplane engine, derive from it. The transformer—a familiar word to all interested in wireless—is simply Faraday's ring experiment elaborated and brought into practical use. And there are other transformers, on exactly the same principle but weighing many tons, which can "step-up" current at low pressure to the higher pressures at which long-distance transmission becomes economical—thus bringing the benefits of electricity into remote villages or isolated farms. In the condenser—another indispensable piece of apparatus for wireless reception—we recognise Faraday's genius by our term for the measurement of the condenser's capacity; the unit being the "farad." The huge motors that will drive even a steel rolling mill—the heaviest work known to industry; the motors that drive the machinery in thousands of



A modern transformer station.

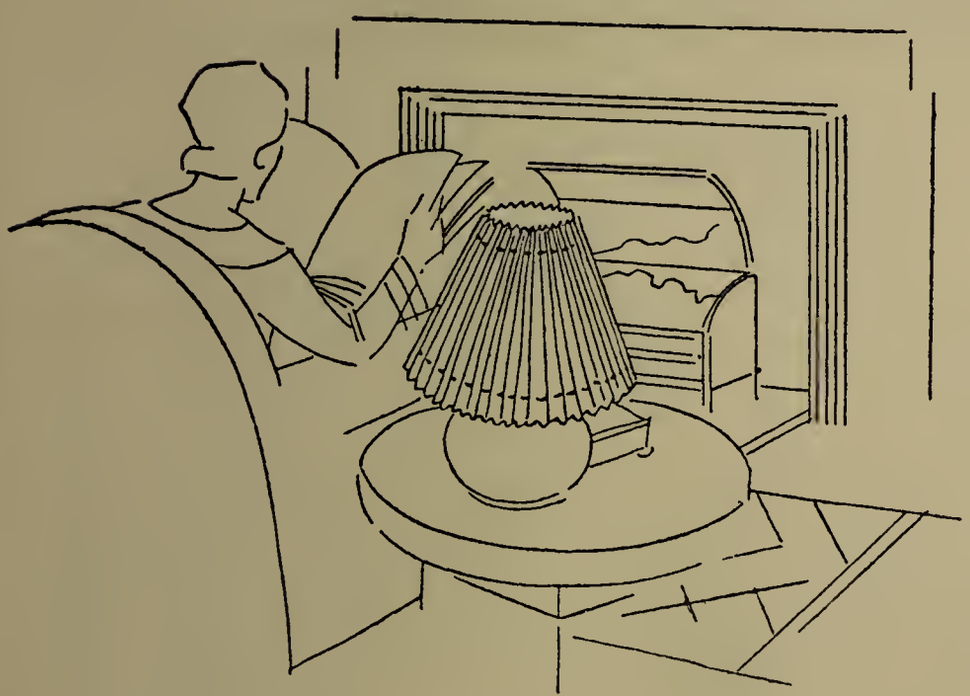
factories; the tiny motors that will drive a sewing machine or a vacuum cleaner, are the busy children of Faraday's brain. All over the world there are societies, associations, organisations, studying the innumerable branches of electrical science and expanding the scope of its applications. If we were to limit our consideration merely to the growth of communication it would still be enough to emphasise our immense debt to Faraday. For without the means to generate electricity on a large scale hundreds of scientists would have had to seek fame in other fields; Sir Oliver Lodge, Senator Marconi, Sir Ambrose Fleming, and many others whose unwearying labours have enabled intelligible conversation to be carried on between countries separated by thousands of miles of ocean, would have been helpless. We accept these wonders calmly; we pick up the telephone and talk to a friend in a distant town without any thrill or surprise; yet it is well to remember what years of investigation, what perseverance and patience are behind that easy, everyday action.



A modern power station.

From the most impressive demonstrations of electrical energy—the transmission lines carrying current at 132,000 volts over the country, or the million-volt "spark" several feet long produced in research laboratories for testing purposes—to the ordinary and normal uses of electricity in the home, the street, the office, we owe our acknowledgments to Michael Faraday. The light that we switch on so casually, the heat and power that are instantly available in so convenient a form without smoke or fumes, the many minor applications of electricity which do so much to lessen the drudgery of the home —the washing machine, the vacuum cleaner, the electric iron, the electric kettle, and a hundred other handy appliances—all can be traced back through the long line of other keen investigators, experimenters, mathematicians, engineers, to the fundamental work done by Faraday in 1831 at the Royal Institution.

How rich a gift to humanity, and how worthy is its giver of all the honour bestowed upon his memory!



". . . light . . . heat . . . instantly available . . ."

The modern generator provides electric power for industry, transport, and communications.

E.D.A. 945.
Published by the British Electrical Development Association, Inc., 15 *Savoy Street, W.C.*